

The Re-definition of Pimpline Genus *Hymenoepimecis* (Hymenoptera: Ichneumonidae) with a Description of a Plesiomorphic New Costa Rican Species

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Abstract.—An aberrant new species of the Neotropical genus *Hymenoepimecis*, *H. argyraphaga* Gauld n. sp. is described from Costa Rica, and the genus is redefined to accommodate this new taxon. A key is provided to identify the Costa Rican species. It is hypothesised that *H. argyraphaga* occupies a basal position in the genus, and is the sister group to all other species. The systematic position of *Hymenoepimecis* within the *Polysphincta* genus-group is discussed and a sister-group relationship with *Acrotaphus*, another New World genus, is demonstrated. It is suggested that this clade has arisen from within a paraphyletic “*Polysphincta*” complex, a cosmopolitan group that has yet to be resolved as a series of monophyletic taxa. Host records for the clade are summarised, and it is shown that the group are specialist parasitoids of orb-web spiders of the families Araneidae and Tetragnathidae.

Hymenoepimecis is an exclusively neotropical genus of ichneumonid wasps that belongs to the *Polysphincta* complex of genera, the “*Polysphinctini*” sensu Townes (1969), a monophyletic clade that has arisen from within the pimpline tribe Ephialtini (Wahl and Gauld, 1998). This clade is biologically unique within the Ichneumonidae because all members are koinobiont ectoparasitoids of spiders (Fitton *et al.* 1988; Gauld 1991; Gauld *et al.* 1998). Elsewhere in the Hymenoptera such an association is only known in a few Pompilidae (Wasbauer 1995). The female ichneumonid temporarily paralyzes a spider by stinging it, and then attaches an egg either to the cephalothorax (the *Schizopyga/Dreisbachia* subgroup) or to the abdomen (the *Polysphincta* and *Zatypota* subgroups). The ichneumonid larva develops as an ectophagous parasitoid on the active spider. The *Hymenoepimecis* of southern Mesoa-merica are reasonably well-known (Gauld 1991; Gauld *et al.* 1998), but recently, a new species of has been found in Costa Rica which possesses certain plesiomorphic features that necessitate redefining the

genus. The purpose of this paper is to do this, and to describe and characterise this new species, in order to provide a taxonomic background for the following paper (Eberhard, 2000) which describes the biology of these fascinating insects.

Genus *Hymenoepimecis* Viereck

Epimecis Brullé 1846: 112. Type-species: *Epimecis bicolor* Brullé, designated by Ashmead 1900: 54. [Junior homonym of *Epimecis* Hübner.]
Hymenoepimecis Viereck 1912: 149. [Replacement name for *Epimecis* Brullé.]

Diagnosis.—Medium to large insects (fore wing length 6–14 mm) which are generally orange with black marking, with the wings from more or less hyaline to completely black, occasionally black and yellow patterned. Head somewhat globose, though abruptly declivous posteriorly; clypeus simple, not transversely divided, flat, apically truncate or slightly concave; mandible slender, strongly tapered with upper tooth distinctly the longer; palp formula 5:4; occipital carina very strong, dorsally convex, flange-like, continuous to base of mandible, with part just

below level of foramen magnum expanded to approach its counterpart below neck in some species; eyes large; antennae long and slender. Pronotum in profile from moderately to exceptionally long, with anterior margin reflexed, projecting below the occipital flange, with part immediately behind this modified into a anteriorly opening "pocket-like" structure; epomia entirely absent. Mesoscutum smooth and polished, more or less glabrous; notauli weakly to moderately impressed; mesopleuron polished, with epicnemial carina from completely absent to present ventrally, but laterally not reaching above level of lower corner of pronotum; metapleuron polished, with submetapleural carina usually absent, sometimes present anteriorly; propodeum quite short and evenly rounded posteriorly, without discernible carina, except for vestiges peripherally, but never with any enclosed area; propodeal spiracle more or less circular. Legs slender, but with fore legs variously developed, sometimes of similar size to middle legs, but often enlarged and with the fore femur conspicuously larger than middle femur; claws of female with large basal lobe, which in many species is high and short, but in one large South American species group is long and low, almost tooth-like; claws of male simple, with a small internal membranous vesicle. Fore wing with *3rs-m* entirely absent, but always with *2rs-m* quite long; hind wing with first abscissa of *M+Cu1* straight or weakly angled proximal to its centre; distal abscissa of *Cu1* present, joining *cu-a* from slightly to conspicuously closer to *M* than to *1A*. Metasoma slender, depressed, polished and more or less impunctate; tergite II with weak to strong oblique impressions anterolaterally, tergites III-IV with weak lateromedian convexities; ovipositor with a distally angulate basal swelling ventrally, with shaft from more or less straight to slightly up-curved, 1.0–1.4 times the length of the hind tibia,

weakly swollen centrally, apically elongately tapered to a fine sharp point.

Remarks.—*Hymenoepimecis* is a Central and South American genus, comprising eight described species (Yu and Horstmann 1997). Approximately ten undescribed species are known mainly from lowland or mid-altitude South America, occurring between sea-level and 1800 metres (in collections of American Entomological Institute, Gainesville, and The Natural History Museum, London). The geographical range of the genus extends from tropical Mexico and Cuba south to subtropical Southern Brazil (c. 29°S). In earlier systematic works (e.g., Townes 1969), the genus has been described as lacking both the epicnemial and submetapleural carinae, but recently an exception has been found in Costa Rica. This somewhat aberrant species has a discernible epicnemial carina and a more or less fully developed submetapleural carina. However, its generic placement is attested by the possession of two autapomorphies of *Hymenoepimecis*. First, the pronotum is mediodorsally modified to have a unique anteriorly opening "pocket-like" flange just behind the reflexed anterior margin. Second, the fore legs are enlarged, with the femora slightly larger than the middle femur. These apomorphies are unique within the Pimplinae, and strongly suggest that the slightly expanded *Hymenoepimecis* is a monophyletic group.

Systematic position.—*Hymenoepimecis* belongs to the *Polysphincta* genus-group (= *Polysphinctini sensu* Townes 1969), a clearly definable monophyletic clade of Ephialtini (Wahl and Gauld 1998). It is putatively the sister group of another primarily Neotropical genus, *Acrotaphus*, a relationship that is supported by three autapomorphies. First, the occipital carina is strongly raised, flange-like, and projects posteriorly to surround the anterior reflexed end of the pronotum. Second, the head is rounded (more or less "door-knob shaped") with the genae strongly nar-

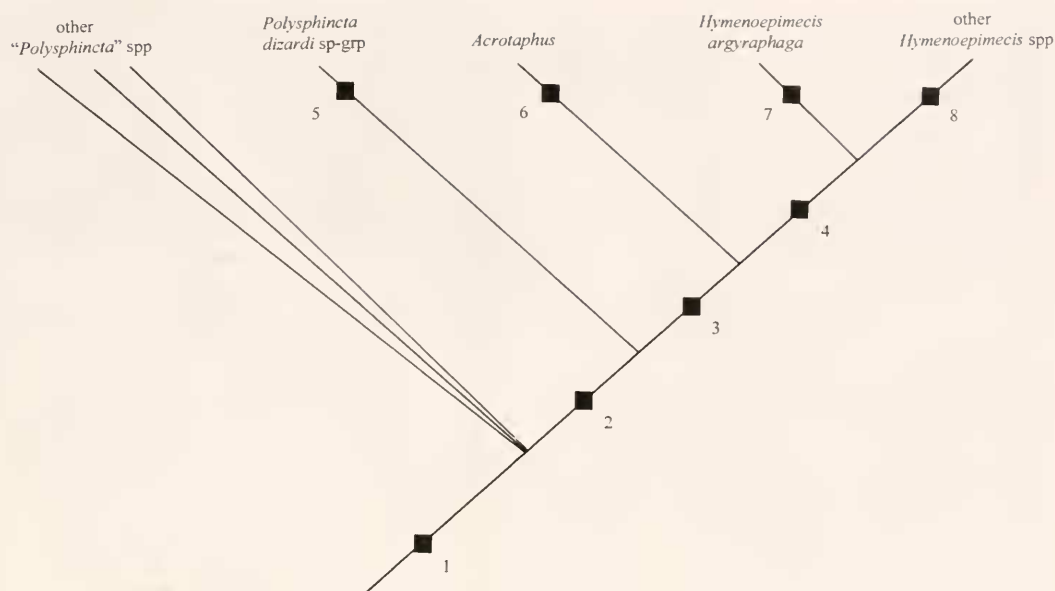


Fig. 1. Cladogram summarizing hypotheses of relationship of *Hymenoepimecis argyraphaga*. The derived features supporting these clades are: (1) long straight ovipositor with an angulate basal swelling; metasomal tergites II-III biconvex; (2) absence of epomia; enlarged ocelli and eyes; (3) occipital carina is strongly raised, flange-like, projecting backwards to surround the anterior reflexed end of the pronotum; head rounded with genae strongly narrowed from eyes to occipital flange; pronotum unusually elongate, with a long horizontal part mediodorsally; (4) pronotum mediodorsally with a forwardly directed "pocket-like" flange; fore legs enlarged, with the femora of similar size to or larger than the mid femur; (5) presence of a horizontal pronotal "shelf"; (6) cocoon without a caudal orifice; (7) wings uniformly blackish; (8) loss of epicnemial carina; loss of submetapleural carina. All characters are polarized with reference to the condition in *Tromatobia*.

rowed from the eyes to the occipital flange. Third, the pronotum is unusually elongate, with a long horizontal part mediodorsally.

The *Hymenoepimecis*/*Acrotaphus* clade is, in its turn, the sister group of yet another Neotropical group, the *Polysphincta dizardi* species-group (Gauld 1991). All three of these taxa lack any trace of an epomia, and are slender, highly polished insects with enlarged eyes and ocelli.

This entire lineage is part of the *Polysphincta* subgroup, a large cosmopolitan group of species that is characterized by having a uniquely basally swollen, ovipositor, and possessing biconvex metasomal tergites II-IV. The detailed phylogeny of this clade has yet to be fully resolved, but the genus *Polysphincta* (*sensu* Townes, 1969 and all subsequent authors) is apparently a paraphyletic assemblage, although

most of the species-groups within it are demonstrably monophyletic (Gauld 1991; Gauld *et al.* 1998) (Fig. 1).

All recorded hosts of the *Polysphincta* subgroup (i.e., "*Polysphincta*" s.l., *Acrotaphus* and *Hymenoepimecis*) are orb-web spiders of the families Araneidae and Tetragnathidae (Nielsen 1923; Townes and Townes, 1960; Fitton *et al.* 1988; Fincke *et al.* 1990; Gauld 1991). All records of "*Polysphincta*" are from Araneidae (e.g. Townes and Townes 1960; Fitton *et al.* 1988; unpublished records in Natural History Museum, London), whereas various species of *Acrotaphus* and *Hymenoepimecis* have been reared either from Araneidae or Tetragnathidae (Shannon 1913; Gauld *et al.* 1998; Eberhard 2000).

Costa Rican species.—Despite a very intensive country-wide sampling programme (Hanson and Gauld, 1995), spe-

cies of *Hymenoepimecis* are rather seldom collected in Costa Rica. Three species have been recorded (Gauld *et al.* 1998), but recently a fourth, undescribed species has been found on the Pacific coastal plain. Unusually for parasitoids, the majority of the Costa Rican *Hymenoepimecis* specimens in collections (25 out of 36) have been reared, rather than field-collected. Hosts are known for all of the four Costa Rican species. *Hymenoepimecis tedfordi* Gauld has not uncommonly been reared by W.G. Eberhard as a parasitoid of *Leucauge mariana* (Keyserling) (Tetragnathidae) (Gauld 1991), several specimens of *H. robertsae* Gauld have been found in Panama para-

sitizing *Nephila clavipes* (L.) (Tetragnathidae) (Fincke *et al.* 1990) and a single individual of the apparently rare *H. heidyae* Gauld has also been reared by W.G. Eberhard at La Selva, from *Cyrtophora nympha* (Simon) (Araneidae). The new species has been reared from by W.G. Eberhard from *Plesiometa argyra* (Walckenaer) (Tetragnathidae).

As mentioned above, the new species differs strikingly from all previously described *Hymenoepimecis* in possessing a number of plesiomorphic features. It is described below, after a key which will facilitate its separation from other, sympatric species.

KEY TO SPECIES OF HYMENOEPIMECIS PRESENT IN COSTA RICA

1. Fore wing uniformly blackish; submetapleural carina discernible, reaching at least 0.5 times length of metapleuron (Fig. 2); epicnemial carina present ventrally, although not laterally extended far onto mesopleuron. *argyraphaga* Gauld, sp. n.
 - Fore wing more or less hyaline, at most slightly infumate distally; submetapleural carina more or less absent (Fig. 3), at most discernible as a small denticle on extreme anterior margin of metapleuron; epicnemial carina only discernible as weak swellings ventrally either side of mid-line 2
 2. Metasoma with tergites all entirely black; sternite I with a low, rounded swelling posteriorly; pronotum long, so that distance from tegula to head is about 0.6 times distance from tegula to hind margin of propodeum *tedfordi* Gauld
 - Metasoma with tergites predominantly orange; sternite 1 with a large acute or nasute protuberance near posterior margin (Fig. 3); pronotum exceptionally long, so that distance from tegula to head is greater than 0.7 times distance from tegula to hind margin of propodeum 3
 3. Hind coxa and femur orange; sternite I with an acute, thorn-like ventral projection; female with ovipositor 1.0–1.2 times as long as hind tibia; hind leg slender, with tibia and tarsus combined, more than 0.9 times fore wing length. *robertsae* Gauld
 - Hind coxa and femur extensively black; sternite I with a high laterally compressed nasute ventral protuberance; female with ovipositor 1.3–1.4 times as long as hind tibia; hind leg fairly stout, with tibia and tarsus combined about 0.6 times fore wing length. *heidyae* Gauld
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Hymenoepimecis argyraphaga Gauld, sp. n.

Female.—lower face elongate 0.8 times as broad as high (from clypeofacial suture to base of antenna), flat, centrally smooth and impunctate, laterally with fine setiferous punctures bearing long fine hairs;

head in dorsal view with gena long, strongly but evenly narrowed behind eyes; ocelli of moderate size, the lateral one separated from eye by about 0.7 times its own maximum diameter; lower end of occipital carina only very weakly raised, not produced mesally to approach its counterpart on the midline. Pronotum

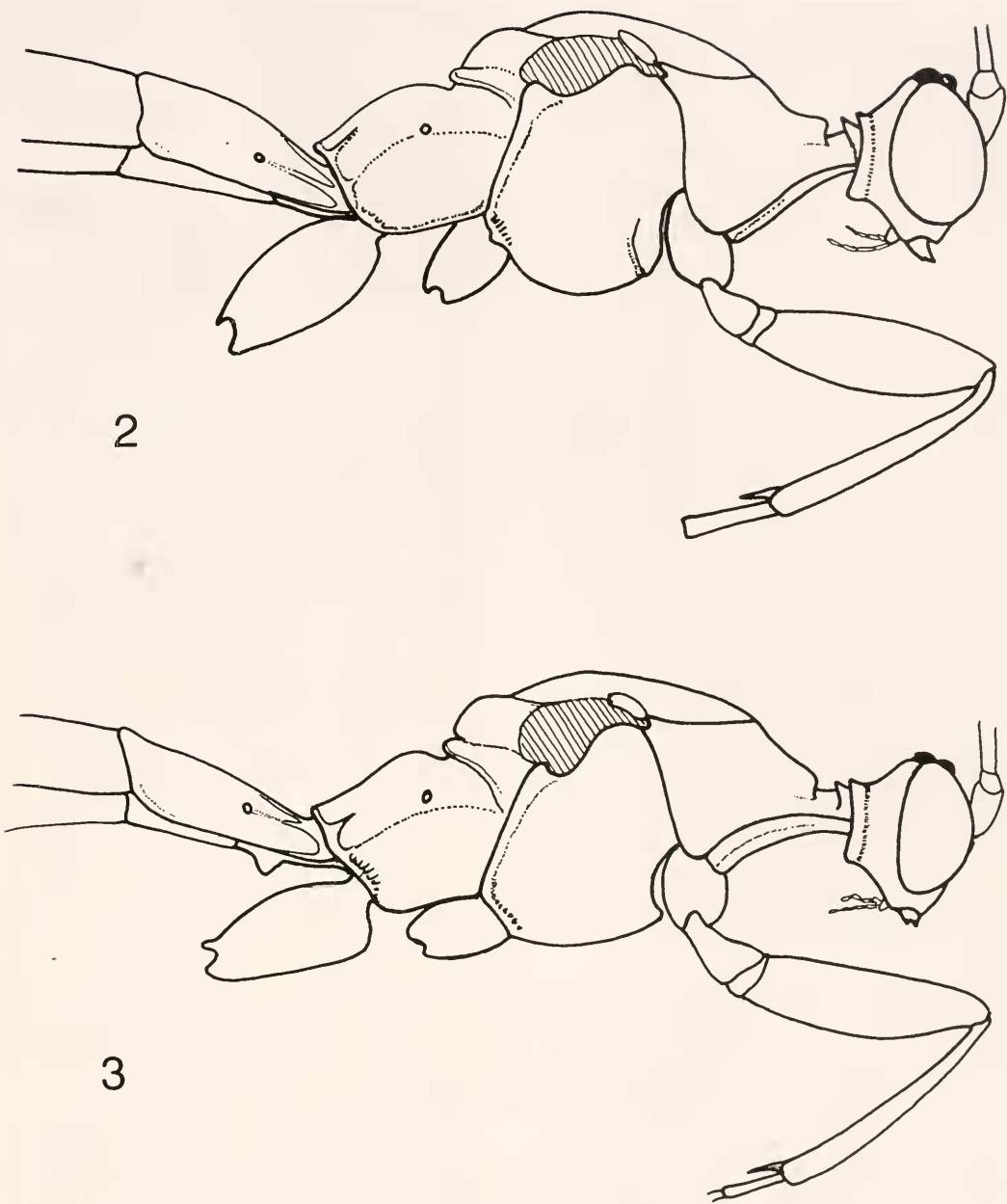


Fig. 2-3. 2, *Hymenopimecis* spp. 2, *H. argyraphaga*, head, and mesosoma, lateral. Note the comparatively plesiomorphic body shape, in comparison with Fig. 3. 3, *H. robertsae*, head, and mesosoma, lateral, showing typical body form of members of this genus.

long so that distance from tegula to head is about 0.6 times the distance from tegula to hind margin of pronotum; scutellum in profile strongly convex; mesopleuron smooth and polished; epicnemial carina

present ventrally, weak but extending across the ventral portion of the mesosoma so that it is just visible in profile; metapleuron quite convex, smooth and polished, glabrous; submetapleural carina ex-

tending at least 0.5 of length of pleuron, usually more or less complete; propodeum smooth, laterally with very fine setiferous punctures. Fore wing length 8.0–8.5 mm; *cu-a* slightly distal to base of *Rs&M*; *2rs-m* about 0.6 times as long as abscissa of *M* between *2rs-m* and *2m-cu*; hind wing with abscissa of *Cu1* between *M* and *cu-a* 0.3–0.4 times as long as *cu-a*. Hind leg moderately long and slender with tibia plus tarsus 0.6 times the fore wing length; hind tarsal claws short, with a deep basal lobe (this condition is common to all Costa Rican species, but in South America a large number have the claw unusually long, and the lobe low, sometimes tooth-like). Metasoma moderately slender, tergite I 1.4–1.5 times as long as posteriorly broad, centrally evenly convex, with lateral carinae present only anteriorly bordering the anterior concavity; sternite I with a low rounded medioventral prominence; tergite II 1.1–1.2 times as long as posteriorly broad, with weak oblique grooves anterolaterally; tergite III about 1.2 times as long as posteriorly broad with a median anterior swelling, centrally glabrous and with scattered hairs around the periphery of the tergite; tergites IV–V similar in sculpture and pilosity; ovipositor 1.0–1.1 times as long as hind tibia.

Head black with mouthparts yellowish brown; antenna blackish; mesosoma orange-brown; metasoma with anterior two or three tergites orange anteriorly and broadly infuscate posteriorly, the area of infuscation increasing in extent and intensity on each tergite progressively towards the hind end, which has the tergites black; ovipositor sheath black. Anterior two pairs of legs orange-brown, the hind legs blackish, with bases of coxae brownish. Wings blackish infumate, pterostigma and veins black.

Male.—similar to female in structure and colour; claspers black.

Material examined.—Holotype ♀, Costa Rica, Puntarenas Province, Parrita, 20 m,

i.1996 (Eberhard) (Natural History Museum, London). Paratypes: 3 ♀, 3 ♂, same locality as holotype (Eberhard) (American Entomological Institute, Natural History Museum, London and INBio, Santo Domingo, Costa Rica).

Remarks.—*Hymenoepimecis argyraphaga* may easily be recognized in Costa Rica by its black wings. I have seen no other species, described or undescribed with uniformly black wings, although several South American species, including *H. heteropus* (Kriechbaumer) have black and yellow patterned wings. *Hymenoepimecis argyraphaga* is also the only species I have seen in the genus with discernible epicnemial and submetapleural carinae, and unlike other species it does not have the lower end of the occipital carina produced mesally more or less to meet its counterpart medioventrally and partially close the oral fossa. The possession of these plesiomorphic features strongly suggests *H. argyraphaga* is one of the more basal species in the genus. This is supported by other features. *H. argyraphaga* has short, deep hind tarsal claws, like *Acrotaphus*, whereas most South American species have highly modified long, low claws with a tooth-like basal lobe. Additionally sternite I of this species is not modified but it generally has a thorn-like protuberance in other species. Furthermore, although enlarged, the fore legs of *H. argyraphaga* are not as massive as many of the apparently more derived species in the genus.

These preliminary suggestions about both the phylogenetic position of *H. argyraphaga* within *Hymenoepimecis* and of this genus with respect to others in the genus-group, have important implications for understanding the evolution of biological traits within this uniquely adapted group of ichneumonids.

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